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Doping control in horses in the Czech Republic in 2010-2019

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Abstract

The aim of this study was to evaluate data on doping controls in racehorses over a given ten-year period, primarily to identify positive findings and to summarise recommendations for the prevention of accidental contamination with prohibited substances, where appropriate. Data on doping controls of racehorses in the Czech Republic from 2010 to 2019 were obtained from the archives of the Jockey Club of the Czech Republic. For each year, the total number of horses starting at races held in the Czech Republic, the number of horses tested, and the results of the doping controls were determined. Data on the type of samples, positive findings and statements from responsible persons about the cause of the positive finding were recorded. During the monitoring period, 11,852 horses competed in races in the Czech Republic and 641 of them underwent a doping control. Blood was taken from 356 horses as the sample for testing and urine was collected from 285 horses. A total of 13 positive findings (2.03% of the 641 tested) were found during the period, namely of morphine, caffeine, theobromine, omeprazole sulphide, furosemide, clenbuterol, norketamine, ritalinic acid, dexamethasone, flunixin, hydroxylidocaine and oripavine. The most common cause, in a total of seven horses, was confirmed as suspected feed contamination. Prevention of positive doping results in our circumstances should therefore be directed primarily towards compliance with proper feed and stable management.

Doping, feed contamination, racehorses, prevention

According to the Racing Rules of the Czech Republic, issued by the Jockey Club of the Czech Republic, the Racing Commission has the right to order the collection of necessary biological samples from any of the participating horses at any time during the race day, especially from all horses whose behaviour before, during or after the race seems to be abnormal and also at any time during a racehorses' career (Jockey Club 2020).

Testing is performed using blood or urine samples. Urine is usually considered the best test fluid for doping control as it contains the highest proportion of metabolites of doping substances and its collection can be performed non-invasively (Waraksa et al. 2018). Thus, urine collection is attempted first. Such a sample is waited for up to one hour after which a blood sample is taken. This is usually easier to obtain but represents an invasive procedure. The samples are sent to accredited laboratories where they are tested for the presence of the prohibited substance and, in selected substances, also for their quantity. At present, samples which are taken from racehorses in the Czech Republic are sent to the laboratory in Deutsche Sporthochschule Köln (Cologne, Germany). The substances referred to in Article 6A of the International Agreement on Breeding, Racing and Wagering (hereinafter referred to as the International Agreement) are considered to be capable of giving a horse an advantage or causing it to be disadvantaged in a race (IFHA 2021).

The aim of this study was to evaluate data from doping controls in racehorses over a given ten-year period, primarily to identify positive findings and to summarise recommendations for the prevention of contamination of horse's body with prohibited substances, where appropriate.

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Materials and Methods

Data on doping controls of racehorses in the Czech Republic from 2010 to 2019 were obtained from the archives of the Jockey Club of the Czech Republic. For each year, the total number of horses starting at races held in the Czech Republic, the number of horses tested, the results of the doping controls, the type of samples and positive findings were recorded. In addition, the sex of the horses that tested positive was also recorded.

The ratio of horses tested and horses testing positive each year were evaluated from the data obtained. For those results that are listed as 'non-detectable', the reason why this was the case is given. For positive findings, the officially published reason why doping substances were found in the horses was recorded.

Results

During the monitoring period, a total of 11,852 horses competed in races in the Czech Republic; all of them were Thoroughbreds. Of them, 5.4% (641 in total) underwent doping control. Blood was taken from 356 horses as a sample for testing and urine was collected from 285 horses. During the period, 13 positive findings (2.03% of the 641 tested) and 12 different substances alone or in combination were found. Over the same period, four samples were determined to be non-detectable (three samples were undetectable due to haemolysis of sample B and one due to insufficient sample quantity). Positive findings were found in seven geldings (53.8%), four mares (30.8%), and two stallions (15.4%). The data found in each year are recorded in Table 1.

Table 1. Data from doping controls over the period 2010 to 2019.

Year	Total of racing horses	Tested	Blood	Urine	Positive	Undetectable	Findings	Sex
2010	1325	57	28	29	1	1	Morphine	Stallion
2011	1378	67	47	20	1	0	Omeprazole sulphide	Gelding
2012	1300	49	24	25	0	0	-	-
2013	1255	37	17	20	0	0	-	-
2014	1198	35	10	25	0	0	-	-
2015	1188	73	47	26	4	0	Caffeine, theobromine	Gelding
							Caffeine, theobromine	Gelding
							Morphine	Mare
							Furosemide, clenbuterol	Mare
2016	1128	91	56	35	1	0	Norketamine	Gelding
2017	1046	67	41	26	1	0	Ritalinic acid	Gelding
							Dexamethasone	Mare
2018	1038	88	46	42	3	3	Flunixin	Mare
							Morphine	Stallion
2019	996	77	40	37	2	0	Hydroxylidocane	Gelding
							Morphine, oripavine	Gelding
Total	11852	641	356	285	13	4		

The highest number of positive findings was in 2015 when four horses (out of 73 tested) were found to have a total of five different substances. In contrast, no positive findings were found in 2012, 2013, or 2014. The percentage of positive findings from all horses tested each year is shown in Fig. 1.

The officially reported reasons (in the records of the Jockey Club of the Czech Republic) for the positive findings in racehorses during our study period are summarised in Table 2.

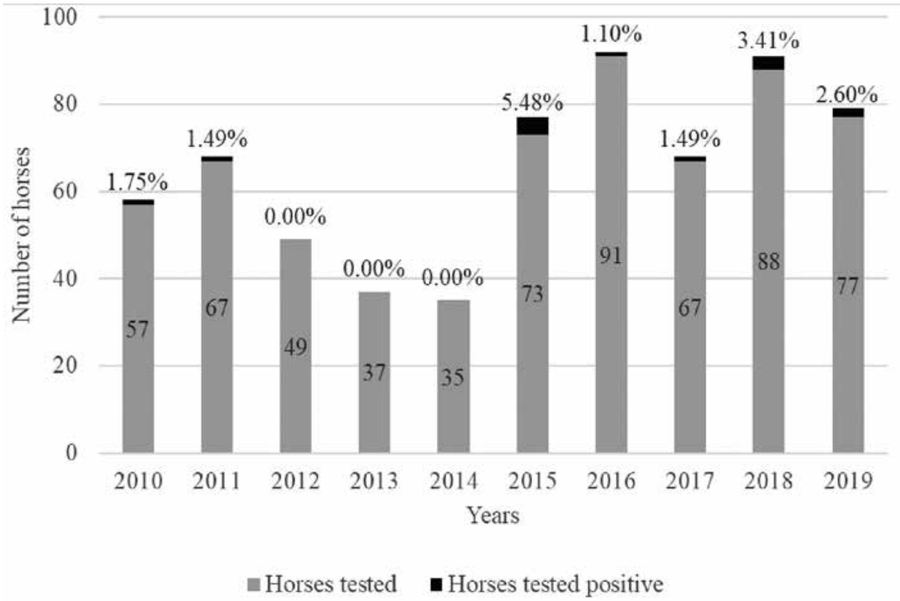

Fig. 1. Number of horses tested and horses testing positive

Table 2. The officially reported reasons for the positive findings in racehorses from 2010 to 2019.

Officially reported reasons	Number of cases	Findings
Confirmed or suspected feed contamination	7	Morphine, oripavine, caffeine, theobromine, dexamethasone, flunixin
Failure to comply with the time required for elimination of the substance	1	Hydroxylidocaine
Deliberate administration by an unknown person	1	Ritalinie acid
Unclear cause	4	Morphine, omeprazole sulphide, furosemide, clenbuterol, norketamine

Discussion

Urine and blood collection are used for testing for the presence of banned substances in racehorses in the Czech Republic. Another matrix that can be used for testing is the hair, which has become increasingly used in recent years for doping control purposes (Dunnett and Lees 2004; Thevis et al. 2016). In the Czech Republic, this matrix was not used at all in doping controls of racehorses during the period under review.

Prohibited substances and methods in racehorses are defined in Article 6A of the International Agreement. The substances here are generally defined and include a huge range of substances that are not specifically listed. Furthermore, Article 6A of the International Agreement also lists substances for which thresholds are set (IFHA 2021).

Information on the results of doping control in the scientific literature is very limited and the percentage of positivity is variable in individual countries. Taddei et al. (2011) reported positivity in 0.45% of samples collected from race horses in Illinois over a 5 year period. Waller et al. (2022) found 1.01% positive samples out of 27,237 blood and 25,672 urine samples collected at Loussiana racetracks from 2016 to 2020. On the contrary, Lotfollahzadeh et al. (2010) reported positivity in 306 of 656 samples (46.6%) collected in the period of 2002–2003 in Iran. Spanoudes and Diakakis (2015) reported 161 positive cases in a total of 94,800 racehorses collected on Cyprus in the period of 2001–2010.

Of the substances detected during the period under review, caffeine, morphine, theobromine and oripavine may occur naturally in some plants. The methylxanthines, caffeine, and theobromine, act as central nervous system stimulants and their administration may have an antisoporific effect, reducing drowsiness and fatigue, and increasing work capacity (Gilman et al. 1990). Caffeine stimulates the respiratory centres, relaxes bronchial smooth muscle, and has complex cardiovascular effects (Greene et al. 1983). More than 60 plants have been found to contain caffeine (Snyder et al. 1981). The main source of theobromine is cocoa and in addition, theobromine is produced in the horse as a metabolic product of caffeine (Budhraja et al. 2007). Caffeine and theobromine were detected in two horses from the same stable in our study and it was confirmed by analysis that the source was commercial feed containing these substances.

Opiates such as morphine are commonly used as analgesics and pre-anaesthetics in many animal species, including humans. In horses, however, opiates can cause sympathetic stimulation and central nervous system excitation when systemically administered (Tobin and Miller 1979; Combie et al. 1979). They may also cause excitement, increased locomotor activity and muscle tone in horses (Kalpravidh et al. 1984) and cardiovascular stimulation (Muir et al. 1978). Morphine was detected in four horses in our study, in one case in combination with oripavine. These opioids are found in poppies. When horses are given bakery products containing poppy seeds (*Papaver somniferum*), they can produce detectable concentrations of morphine in urine (Kollias-Baker and Sams 2002). In the two positive cases detected in our study, morphine, in one case together with oripavine, was detected in the compound feed, which was confirmed by the feed manufacturer. In the third case, poppy seeds were detected in the fed oats. The horse was trained in the same area where poppy was processed. In the last case, it was not established how morphine could have entered the horse's body.

Omeprazole is a potent inhibitor of gastric acid secretion and is used to treat gastric ulcers, something to which racehorses are particularly prone. According to a study by Johnson et al. (2001), up to 90% of Thoroughbred racehorses, and according to a study by Bezděková et al. (2005), over 60% of trotting horses in the Czech Republic suffer from gastric ulcers. Studies suggest that omeprazole treatment is unlikely to be associated with significant improvements in athletic performance (Kollias-Baker et al. 2001; McKeever et al. 2006). Omeprazole sulphide, which is a metabolite of omeprazole, was detected in one horse but the trainer said it was unclear how the substance entered the horse's system.

Lidocaine is used in horses as a local anaesthetic and an antiarrhythmic drug (Van Hoogmoed et al. 2004). According to the trainer of the horse that tested positive for hydroxylidocaine which is a metabolite of lidocaine, the presence of this substance was due to its use in the stomatologic treatment before racing, which was confirmed by the attending veterinarian. It is therefore clear that they did not meet the time limit required to exclude the drug before the race.

Dexamethasone belongs to glucocorticoids, a group of potent anti-inflammatory and immunosuppressive drugs that are often used in horses. Systemic administration of glucocorticoids is standard in the treatment of a number of immune-mediated diseases. Glucocorticoids are known to increase endurance in rats and humans (Gorostiaga et al. 1988; Viru et al. 1994; Le Panse et al. 2009). In our study, one horse tested positive for dexamethasone. There was another horse in the same box that had been treated with this corticosteroid, so in this case, the horsebox or feed may have been contaminated and the drug ingested accidentally.

Flunixin is a non-steroidal anti-inflammatory drug (NSAID). These drugs are primarily used in horses for the treatment of pain and inflammation of soft tissue, and abdominal and musculoskeletal tissue. Therefore, they are also often used in horses as part of the treatment of sports-related injuries (Knych 2017). There is little evidence that NSAIDs alone lead to increased performance. Instead, they mask pain and increase mobility through potent inhibition of cyclooxygenase enzymes known as COX 1, 2, and 3 (Knych 2017). In the case of our study, the trainer of the horse with a positive flunixin finding confirmed that there was a feed mix-up with a horse in the next box that was treated with this agent.

Clenbuterol, a β2-agonist, is a potent selective bronchodilator used to treat bronchospasm in horses (Sasse and Hajer 1978). Unfortunately, this drug has also been used as an anabolic agent, both in food animals and informally in humans and horses. It is particularly known for its ability to elicit an anabolic response in the horse by targeting muscle proteins (Kearns et al. 2001). Indeed, clenbuterol increases muscle mass while decreasing fat mass (MacLennan and Edwards 1989). Thus, clenbuterol not only acts as a repartitioning agent, but also alters circulating plasma concentrations of adipokines (Kearns et al. 2006). In the case of the positively testing horse in our study group, it is unclear how the substance entered the body. However, furosemide, which is known as a doping masking agent, was additionally detected as a second substance in the same horse. Furosemide is a common crank diuretic that is responsible for increasing urine output. This drug has a rapid onset and short duration of action. Therefore, when racing, it allows for a reduced likelihood of detecting other drugs that may be in the horse's system because it increases urine output, thereby increasing the excretion of other drugs that have been administered to the horse (Hinchcliff and Muir 1991). In racing horses, furosemide is also used for the prevention of exercise-induced pulmonary haemorrhage and its use in the race is permitted in some countries (Hinchcliff et al. 2009). Thus, in this case, according to the authors, it can be assumed that this was a deliberate administration of clenbuterol and subsequently also furosemide in order to eliminate the former faster.

Norketamine is a metabolite of ketamine hydrochloride. The use of ketamine, most commonly in combination with xylazine, for short-term anaesthesia in horses was first described in the 1970s (Butera et al. 1978; Muir et al. 1978). In addition, ketamine activates the monoaminergic descending inhibitory system, which may play a key role in the analgesic effect of ketamine (Koizuka et al. 2005). Today, ketamine is increasingly being promoted as an analgesic that can be used in combination with other drugs for diagnostic and surgical procedures or for multimodal analgesia in acute or chronic pain. In addition, ketamine has been shown to have locally anaesthetic and potent anti-inflammatory effects (López-Sanromán et al. 2003a,b). According to the trainer of the horse that tested positive for ketamine in our study, it is unclear how the substance entered the body.

Ritalinic acid was detected in one positive horse. This is a metabolite of methylphenidate, a central nervous system stimulant preferred in human medicine for the treatment and long-term management of neuropsychiatric Attention Deficit Hyperactivity Disorder (Askenasy et al. 2007). It induces a feeling of euphoria and well-being in humans but also increases blood pressure and respiratory rate (Martin et al. 1971). In a study by Shults et al. (1981), when methylphenidate was administered i.v. to horses at only 0.4 to 1 mg/kg, it resulted in up to a six-fold increase in the reaction rate above baseline. Clearance of methylphenidate in the urine of horses was determined to be 12 to 24 h. According to the trainer of the positive horse in our group, the substance was probably administered deliberately by an unknown person three days before testing out of competition, with the intention of killing the horse. However, according to known pharmacokinetics (Shults et al. 1981), it is unlikely that the substance would still be detectable in the blood after 3 days. Acute toxicity caused by a methylphenidate overdose in humans has similar symptoms to acute amphetamine intoxication (Rappley 1997). Motor and behavioral symptoms of overdose may include bruxism, repetitive touching or stereotyped confusion, disoriented or repetitive behaviour, obsessive-compulsive tendencies, and aggression (Volavka 1995). Also Gabriel et al. (1963) concluded in their study that methylphenidate was capable of producing CNS stimulation in the horse at dose levels as low as 50 mg and considered that the behaviour of the animal was so affected by larger doses that it would be relatively easy to pick out illegally medicated horses. However, they did not discuss how a methylphenidate-medicated horse could be identified differentially from a spontaneously nervous horse.

Based on the findings during our study period and their rationale as well as based on the guidelines, welfare standards, and best practices developed by International Federation of Horseracing Authorities (IFHA 2020) and Fédération Equestre Internationale (FEI 2021a), the following recommendations to reduce the risk of contamination can be made to trainers and other responsible persons. Hay, feed, and supplements should be bought only from reputable suppliers, be of high quality, and stored in clean closed containers to ensure protection from contaminants. Pastures and their surroundings should be free of plants that can lead to positive findings (e.g. poppy, crocus, nettle, and lupin). Any horse that is receiving treatment should be stabled separately from other horses, and the same stall, paddock or feed bins should not be used for another horse after the treatment. Medication should be kept in a secure place and should not contaminate the feed and stable environment with unauthorised substances when handled. Therapeutic substances should be used appropriately and under veterinary supervision. Application of medicaments should only be carried out by one person at a time to avoid misadministration of a double dose. A medication diary should be carefully kept for each horse. A list of detection times for selected substances published by the European Horserace Scientific Liaison Committee (EHSLC) will then facilitate guidance on the length of time the drug remains in the horse's body (EHSLC 2021; FEI 2021b).

In conclusion, the most common cause of positive doping results in our study was confirmed in seven horses as suspected feed contamination. In one case it was a failure to observe the time required for the elimination of the drug from the organism before racing. In two cases, the authors believe in view of the findings that deliberate administration can be assumed. In three of the horses, it is not clear according to the responsible persons how the substance entered the horse's body. Prevention of positive doping results in our circumstances should therefore be directed primarily towards compliance with proper feed and stable management.

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